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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/536,828	05/27/2005	Makoto Kitabatake	071971-0251	6640
20277 7590 07/10/2007 MCDERMOTT WILL & EMERY LLP 600 13TH STREET, N.W. WASHINGTON, DC 20005-3096			EXAMINER KALAM, ABUL	
			ART UNIT 2814	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/536,828	Applicant(s) KITABATAKE ET AL.	
	Examiner Abul Kalam	Art Unit 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 April 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 and 8-14 is/are pending in the application.
- 4a) Of the above claim(s) 8-14 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 May 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election

Applicant's election of Species I in the reply filed on April 13, 2007 is acknowledged. Because applicant did not distinctly and specifically point out any errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)). Furthermore, Applicant identifies claims 1-6 as readable on the elected species, and thus claims 1-6 will be given full consideration in the Office Action.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. **Claims 1-3 and 5** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Lin (US 6,184,580)** in view of **Litwin (US 6,507,047)**.

With respect to **claim 1**, **Lin** teaches a semiconductor apparatus (**FIGs. 3-4**) comprising:

a semiconductor chip (**20, FIG. 3; col. 3: ln. 58**);

a base material (**45 (26,36,35), FIG. 3; col. 62-64**) made of an electrically conductive material and connected (**through wires 25 and 27**) to a part of a face of said semiconductor chip (**20**);

a heat conducting member (42, FIG. 3; col. 3: Ins. 13-19) in contact with a part of the face (21) of said semiconductor chip (20);

an encapsulating material (28, FIG. 3; col. 4: Ins. 56-62) for encapsulating said semiconductor chip (20) and said heat conducting member (42);

wherein a part (34, FIG. 4; col. 4: Ins. 13-14) of said base material (36) is extruded outside said encapsulating material (28) and works as an external connection terminal (34, FIG. 4);

wherein a first intermediate member (30, FIG. 3) made of an electrically conductive material (col. 5: Ins. 38-41, col. 6: Ins. 25-26) and a second intermediate member (mold 28 provided between base material 36 and chip 20) made of a material having lower heat conductivity (col. 4: Ins. 61-62) than said first intermediate member (first intermediate member 30 is made of copper or aluminum while second intermediate member is made of epoxy resin) are provided between said base material (36) and said semiconductor chip (20, FIG. 3).

Thus, Lin teaches all the limitations of the claim with the exception of disclosing: wherein the semiconductor chip includes a power semiconductor device constructed by using wide band gap semiconductor.

However, Litwin discloses semiconductor chips containing power transistors constructed by using wide band gap semiconductor material (SiC) (col. 1: Ins. 35-67). Litwin discloses that transistors based on silicon carbide, which a well known wide bandgap semiconductor, are another alternative to transistors based on Si or GaAs for power applications at high frequencies.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the semiconductor chip of **Lin** to include wide band gap semiconductor devices, as taught by **Litwin**, because semiconductor devices based on silicon carbide (SiC) are capable of handling high power densities and can operate at high temperatures, thus improving the speed, reliability and performance of semiconductor chips (**col. 2: Ins. 1-10**).

With respect to **claim 2**, **Lin** and **Litwin** teach the semiconductor apparatus of claim 1, as set forth above. Regarding the limitation, "wherein said power semiconductor device has a region where a current passes at a current density of 50 A/cm² or more," Applicant has not shown such a claimed range to be critical and thus, absent evidence of disclosure of criticality for the range giving unexpected results, it is not inventive to discover optimal or workable ranges by routine experimentation. See *In re Aller*, 220 F.2d 454, 105 USPQ 233, 234 (CCPA 1955). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to form a power semiconductor device with a current density as claimed because such current densities are common in high power applications.

With respect to **claim 3**, **Lin** and **Litwin** teach the semiconductor apparatus of claim 1 or 2, as set forth above. Furthermore, **Lin** teaches wherein said encapsulating material (**28, FIG. 3**) is made of resin (**col. 4: Ins. 60-62**), and said heat conducting member (**42, FIG. 3**) is exposed from said encapsulating material (**28**).

With respect to **claim 5**, **Lin and Litwin** teach the semiconductor apparatus of claim 1 or 2, as set forth above. Furthermore, **Lin** teaches a film (**44, FIG. 3**) for covering said encapsulating material (**28**).

2. **Claims 1-3** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Seo et al. (US 2005/0062148, hereinafter Seo)** in view of **Litwin (US 6,507,047)**.

With respect to **claim 1**, **Seo** teaches a semiconductor apparatus (**FIG. 2a**) comprising:

a semiconductor chip (**2, FIG. 2a; ¶ [0026]**);

a base material (**6, FIG. 2a; ¶ [0027]**) made of an electrically conductive material and connected to a part of a face (**2b**) of said semiconductor chip (**2**);

a heat conducting member (**4 and 14, FIG. 2a; ¶ [0029], [0004]**) in contact with a part of the face (**2b**) of said semiconductor chip (**2**);

an encapsulating material (**10, FIG. 2a; ¶ [0037]**) for encapsulating said semiconductor chip (**2**) and said heat conducting member (**4**);

wherein a part (**6f, FIG. 2a; ¶ [0038]**) of said base material (**6**) is extruded outside said encapsulating material (**10**) and works as an external connection terminal (**¶ [0038]**);

wherein a first intermediate member (**8, FIG. 2a; ¶ [0030]**) made of an electrically conductive material (**gold or solder, ¶ [0030]**) and a second intermediate member (**16, ¶ [0031]**) made of a material ("**polyimide**") having lower heat conductivity than said first intermediate member (**insulating material such as polyimide has a lower heat**

conductivity than gold) are provided between said base material **(6)** and said semiconductor chip **(2, FIG. 2a)**.

Thus, **Seo** teaches all the limitations of the claim with the exception of disclosing: wherein the semiconductor chip includes a power semiconductor device constructed by using wide band gap semiconductor.

However, **Litwin** discloses semiconductor chips containing power transistors constructed by using wide band gap semiconductor material **(SiC) (col. 1: Ins. 35-67)**. **Litwin** discloses that transistors based on silicon carbide, which a well known wide bandgap semiconductor, are another alternative to transistors based on Si or GaAs for power applications at high frequencies.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the semiconductor chip of **Seo** to include wide band gap semiconductor devices, as taught by **Litwin**, because semiconductor devices based on silicon carbide (SiC) are capable of handling high power densities and can operate at high temperatures, thus improving the speed, reliability and performance of semiconductor chips **(col. 2: Ins. 1-10)**.

With respect to **claim 2**, **Seo** and **Litwin** teach the semiconductor apparatus of claim 1, as set forth above. Regarding the limitation, "wherein said power semiconductor device has a region where a current passes at a current density of 50 A/cm² or more," Applicant has not shown such a claimed range to be critical and thus, absent evidence of disclosure of criticality for the range giving unexpected results, it is not inventive to discover optimal or workable ranges by routine experimentation. See *In*

re Aller, 220 F.2d 454, 105 USPQ 233, 234 (CCPA 1955). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to form a power semiconductor device with a current density as claimed because such current densities are common in high power applications.

With respect to **claim 3**, **Seo and Litwin** teach the semiconductor apparatus of claim 1 or 2, as set forth above. Furthermore, **Seo** teaches wherein said encapsulating material (**10, FIG. 2a**) is made of resin (**¶ [0037]**), and said heat conducting member (**6, FIG. 2a**) is exposed from said encapsulating material (**10**).

3. **Claim 4** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Lin (US 6,184,580)** and **Litwin (US 6,507,047)**, as applied to claim 3 above, and further in view of **Huang (US 2001/0045644)**.

With respect to **claim 4**, **Lin and Litwin** teach the all the limitations of the claim, as set forth above in claim 3, with the exception of disclosing: the apparatus further comprising a radiation fin that is in contact with said heat conducting member and is extruded outside said encapsulating material.

However, **Huang** teaches a semiconductor package wherein a radiation fin (**260, FIG. 5**) is in contact with a heat conducting member (**210**) and is extruded outside an encapsulating material (**242, FIG. 5; ¶ [0026]**).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to add a radiation fin to the apparatus of **Lin and Litwin**, as taught

by **Huang**, for the disclosed intended purpose of further improving the heat-dissipating effect (**¶ [0026]**).

4. **Claim 6** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Lin (US 6,184,580)** and **Litwin (US 6,507,047)**, as applied to claim 5 above, and further in view of **Patil et al. (US 5,227,663)**.

With respect to **claim 6**, **Lin and Litwin** teach the all the limitations of the claim, as set forth above in claim 5, with the exception of disclosing: the apparatus further comprising a radiation fin opposing said heat conducting member with said film sandwiched therebetween.

However, **Patil** teaches a semiconductor chip package wherein a radiation fin (**96**) opposes a heat conducting member (**82**) with a film (**adhesive**) sandwiched therebetween (**FIG. 3; col. 8: Ins. 29-67; col. 9: Ins. 1-23**).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to add a radiation fin to the apparatus of **Lin and Litwin**, as taught by **Patil**, for the disclosed intended purpose of providing additional heat dissipation, thereby improving the reliability and performance of the device (**col. 9: Ins. 3-16**).

Response to Arguments

Applicant's arguments with respect to claims 1-6 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Abul Kalam whose telephone number is 571-272-8346. The examiner can normally be reached on Monday - Friday, 9 AM - 5 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M. Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2814

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Abul Kalam


PHAT X. CAO
PRIMARY EXAMINER